

# Take it or leave it. Hidden labour along the crisis

Rita Cappariello and Roberta Zizza<sup>1</sup>

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Abstract

The paper identifies the socio-economic characteristics of individuals involved in the Italian underground labour market, with a separate consideration of the periods before and in course of the global financial and euro-area sovereign debt crisis. We exploit the information on self-reported individuals' social security status available from the Bank of Italy's Survey on Household Income and Wealth (SHIW) in order to identify underground workers and derive measures of irregularity, updating to 2014 those presented in Cappariello and Zizza (2010). We show that social and economic characteristics (education, kind of job, sector) play a greater role if compared to demographic ones (gender and age) in shaping the probability of working underground. Moreover, the financial and economic crisis partially changed the potential impact of some determinants behind irregular employment. In particular, before the crisis women showed a higher probability of being in irregular employment than men; this divide lessens after 2008. Also age appears to change its impact before and during the crisis: as the labour market weakens, the probability of being in an irregular position is higher for core-age workers.

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<sup>1</sup> Bank of Italy, Directorate General for Economics, Statistics and Research, Via Nazionale 91, 00184, Rome, ITALY. Email: [rita.cappariello@bancaditalia.it](mailto:rita.cappariello@bancaditalia.it); [roberta.zizza@bancaditalia.it](mailto:roberta.zizza@bancaditalia.it). The usual disclaimer applies: the opinions expressed in this paper are those of the authors and do not involve the Bank of Italy.

## 1. Introduction

Scholars know very well the Bank of Italy's Survey of *Household* Income and Wealth as a powerful tool to investigate issues such as income distribution, inequality, consumption, labour market, etc. (see Bank of Italy, 2015). It is much less known its role as Survey of *Hidden* Income and Wealth. Literature exploiting this information is quite scant. Research has in fact mostly exploited other sources such as currency data (Bovi, 1999; Schneider and Enste, 2000; Zizza, 2002; Ardizzi *et al.*, 2014), consumption of electricity (Kaufmann and Kaliberda, 1996; Lackö, 1996) and audit data (Bordignon and Zanardi, 1997; Di Porto, 2009).

As for official figures, Istat has recently developed a complete and in-depth revision of all the methodologies used to measure the non-observed economy - a statistical concept used to define the components commonly described as the hidden economy - with the aim to support national account benchmark estimates. This methodological overhaul was supported by a committee of experts - including academics and institutional representatives - who were responsible for verifying and discussing the new measurement techniques (Istat, 2014).

Concerning employment estimates, the new methodology is based on the complete integration at the micro level of all the available administrative sources, containing information on paid work (and the relative income) and their exact match with the information collected from individuals through the ongoing Labour force survey with reference to years 2010 and 2011. This method allows to differentiate between the various types of employment, firstly by identifying the line between regular and irregular employment, on the basis of the range of information from administrative sources. In particular, not registered (undeclared) employment is identified in the segments where the presence of a working activity (measured at the individual level) does not correspond to any form of social contribution or taxation payment. On the other hand, the association of the information on regular workers and the enterprises that employ them allows us to draw up a particularly precise picture of the labour input.

While estimates of underground labour based on either macroeconomic models or survey questionnaires are not suitable for national account compilation, and are usually hardly comparable with them, they represent an improvement respectively in terms of timeliness and heterogeneity, providing useful insights to policy makers. Sources of data on income alternative to household surveys, such as social security, obviously do not serve for the scope of measuring these phenomena, as by definition they only cover regular jobs.

This paper deals with underground labour, and borrows from Cappariello and Zizza (2010) for the method of identification of underground workers. Besides, the same dataset has been exploited by Boeri and Garibaldi (2007) to estimate a widening shadow wage gap in the period 1995-2002. Brandolini and D'Alessio (2002) also identify as underground workers those who have never been paid social security contributions (or who have never paid, if self-employed), as well a broader measure based on pension coverage. Both papers then provide a thorough statistical description of the pool of irregular workers; the latter also assesses the role of education achievement in shaping the opportunity/necessity to be informal, showing that a low level of education considerably and significantly increases the probability of working underground. Di Porto and Elia (2014) broadly adopted the same strategy used in Cappariello and Zizza (2010) to identify the underground workers, with the aim of investigating empirically how underground labour affects the wages of undeclared and declared workers and in

particular the declared wage inequality. Their results, based on instrumental variable regressions, indicate that undeclared work adversely affects undeclared wages, increases declared wages and reduces wage inequality in the declared sector. Finally, Capasso and Jappelli (2013) constructed an index of irregular activity at the individual level by dividing the number of years not covered by social security contributions by the length of the working life, as well as derived a proxy of the extent of the underground activity by calculating the fraction of income received in cash. Then these indices were studied in relation to the degree of local financial development.

In this paper we update to 2014 the measures of irregularity presented in Cappariello and Zizza (2010), giving the opportunity to analyse the phenomenon of irregular labour before and in the course of the global financial and the euro-area sovereign debt crisis. To our knowledge, no existing empirical research deals with the potential impact of the crisis on the determinants behind irregular employment at an individual level; indeed De Gregorio and Giordano (2014) exploited micro-data which originate from the production of official figures by Istat but due to the limited time span of those data (2010-2011) the potential role of the economic crisis in shaping the trends in underground labour cannot be taken into account.

The paper is organised as follows. In Section 2 the SHIW is exploited to estimate the extent of hidden labour updating to 2014 the exercise in Cappariello and Zizza (2010). Section 3 evaluates the role of socio-economic characteristics in shaping the probability of working underground. Section 4 concludes.

## **2. Identifying underground workers from the SHIW**

The data from SHIW have constituted a pioneering source for a deeper understanding of the complexity of the underground employment phenomenon; more generally, micro-data are a powerful tool to study the features of irregularity and to enrich the analysis addressing policy issues.<sup>2</sup> The SHIW is carried out every two years and the sample is composed of about 8,000 households, representative of the whole Italian population (Bank of Italy, 2015). The quality of the survey is crucial in evaluating the quality of the estimates. It is indeed well known that there are many risks associated with the use of sample surveys, some of which exceed those of a sampling nature, such as under reporting, non-random non-response, under-representation of some segments of the population, reticence, and so on (Neri and Zizza, 2010).

The SHIW has been designed, and is systematically conducted, with the aim of mitigating the impact of such factors.<sup>3</sup>

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<sup>2</sup> In the past, estimates of irregular labour inputs have been obtained in Italy using indirect tools. Among others, Calzaroni (2000) founded his analysis on a comparison between Census data and Labour Force Survey data.

<sup>3</sup> In particular, for about 80 per cent of the interviews, the Computer-Assisted Personal Interviewing program (CAPI) was used. Thanks to the use of an electronic questionnaire, a number of checks is performed in real time, making it possible to correct any inconsistency in the data during the interview and hence greatly reducing the need for post-survey consistency checks for data quality. The remaining interviews rely on paper-based questionnaires (PAPI, Paper-And-pencil Personal Interviewing), later transferred by the survey company to a computer using the CAPI program.

As it is customary in household surveys, to reach an adequate level of participation – which is not compulsory in for this survey - and to receive reasonably truthful income reports, respondents to SHIW are granted anonymity. Interviews are long (almost one hour), and a specialised company, providing around 180 professional interviewers, is in charge of data collection.<sup>4</sup> Despite the fact that participation is voluntary and respondents are informed at the outset about the content of the survey, they may be reluctant to reply to “sensitive” questions. Interviewers are asked at the end of the interview to assess how reliable the responses provided are, especially with reference to income and wealth; this could help to quantify the impact of this distortion.

Following the methodology in Cappariello and Zizza (2010), we use information on self-reported individuals’ social security positions available in the survey to identify the “irregular workers” on the basis of two different definitions. In the SHIW it is asked whether the person itself, or one of his employers, has ever paid social security contributions. Quoting the questionnaire:

*“Considering the lifetime work experience of ..... (name) , did he/she ever pay, or his/her employer pay, pension contributions, even for a short period (and even if long ago)?”*

According to the first definition, “underground workers” are those who reported to have never paid (or their employers have never paid) social security contributions throughout their entire career stating, at the same time, that they have been working. Individuals who are currently irregular but have cumulated pension contributions in the past, or those whose main occupation is regular but hold an irregular second job are not labelled as underground workers. This estimate, which has been defined as the *narrow measure* of irregular labour, is conceivably on the conservative side, and not strictly comparable to that in the national accounts which includes workers who are *currently* underground.

A further information drawn from the questionnaire dealing with the number of years (or months) the individuals (or their employers) have been paying social security contributions (YCONTR) up to the time of interview is exploited to retrieve a precise indication of social contribution evasion. More specifically, this information is compared with a proxy of the number of years actually worked (EXPER) in order to obtain a second measure of “irregular workers” that occurs when  $YCONTR < EXPER$  and includes those who spent a significant fraction of their working life underground i.e. those who paid too few contributions in comparison with their working experience. Unfortunately the SHIW does not ask the number of years worked, but records both the age at the time of the interview (AGE) and the age when the interviewed started working (AGESTART). The difference between the two definitions of age measures the potential experience ( $POTEXPER = AGE - AGESTART$ ) and corresponds exactly to EXPER only if the worker has had a very regular work history. However, there can be several reasons for this not to be true, such as unemployment spells or on-leave periods.

Given this limitation to the data, as in Cappariello and Zizza (2010), we have utilised some “tolerance” criteria to identify those who spent a significant fraction of their working life underground. In particular, to assess how little the payment of contributions is we look at the pension coverage, given by the ratio between contributions paid and years of experience and label as “underground workers”

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<sup>4</sup> 90 per cent of the interviewers have at least an upper secondary school diploma, the majority have at least ten years’ experience in the field and have taken part in at least two editions of the SHIW. They receive training from officials of the Bank of Italy and representatives of the company.

those for whom the pension coverage is below the first quartile of the distribution of the coverage across individuals of the same gender reporting the same number of jobs held. More formally, we label “underground workers” those individuals satisfying the relative criterion:  $CONTR / POTEXPER < p25$ . It is in fact conceivable that the lower the number of jobs held, the better the variable POTEXPER is proxying the number of years actually worked.<sup>5</sup> We take care of differences by gender as women are likely to present more discontinuous career profiles due to maternity and childcare. This measure is further improved by *excluding* those for which informality has been a stepping stone towards a regular position. For this reason, an absolute criterion (whereas the previous one has a relative nature) has been applied to this estimate, namely the difference between the number of years actually worked and the years of contributions have to exceed 10 years.<sup>6</sup> Adding these partially underground workers to those included in the narrow measure, we get a *broad measure of underground labour*.

It is worthy noticing that even this broad measure is not fully comparable with that provided by Istat, as it includes workers who were “chronically” underground in the past but are regular today and excludes those irregular today but possibly regular for most of their life. Still, this measure tracks reasonably well the dynamics of the three Istat measures, in turn based on different definitions of labour input (persons employed, full time equivalent units, job positions; Table 1 and figure 1).

### 3. Modelling the probability of working underground

The identification of irregular workers is exploited to test empirically for Italy the relationship between underground labour and a wide range of socio-demographic characteristics at the individual level. The results in this paper span on a longer time period than that covered in Cappariello and Zizza (2010). Here we pool the observations in the nine surveys conducted from 1998 to 2014. The sample is split into two different periods: the first one includes observations from the six surveys between 1998 and 2008, that is, surveys run before the onset of the financial and economic crisis; the second period includes observations from 2010 to the most recent surveys available (up to 2014). A comparative analysis of the results for the two sub-periods aims at evaluating if and possibly how the crisis and the subsequent recession that followed have modified the determinants of underground labour at the individual level.

Table 2 reports the incidence of irregular labour in selected groups, according to both narrow and broad measures before and during the beginning of the crisis. The crisis did not change the overall diffusion of irregularity in Italy. Indeed, the narrow measure of underground labour becomes even lower after 2008. Probably this can reflect the acceleration in the process of reform of the Italian labour market towards a higher flexibility in the employment of the labour force that took place during the crisis (D’Amuri *et al.*, 2015). Since it has become gradually easier for an employer to hire workers under more flexible arrangements, the pool of individuals who have been working off the book throughout their entire career has plausibly shrunk.

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<sup>5</sup> For those having had only one employer, EXPER and POTEXPER should in principle be coincident. Even among them, however, we detect conspicuous differences between years worked and pension contributions.

<sup>6</sup> The adoption of this criterion is clearly judgemental. For this reason we have checked our results against a lower value (5 years) of the threshold (see paragraph 3).

The percentage of underground workers differs considerably according to geographical location and personal characteristics. Confirming a huge body of literature, as well as the breakdown available in the official national account estimates, irregularity is much more diffuse in the South and in the Isles, irrespective of the measure considered. The proportion of workers in the informal sector is higher among women in both periods of analysis.

Descriptive statistics suggest that before the crisis the age class characterised by a higher incidence of irregular workers was the class of the youngest (14-30 years) if one looks at the narrow measure, while this is not the case for the broader measure, suggesting that informality might play a role as a stepping stone towards regular employment for those entering the labour market. According to the broad measure the core age class (41-50 years) is that characterised by a higher incidence of workers with low pension coverage. In general, the proportion of irregular workers is higher among those who have been always or ever self-employed, also in this case confirming the official trends.

The irregularity status is more frequent among individuals with a compulsory or lower level of education, and broadly decreases with the level of education: the gain when comparing those with at maximum a compulsory level of education with those having a diploma is larger than that emerging from the comparison of those having a diploma with graduates. Finally, again in line with the official statistics, underground labour is more diffuse in agriculture and in the building sector, while services (here including the public sector) and manufacturing are less affected.

The probability of working underground is estimated through pooled probit regressions, where the dependent variable takes a value of one if the individual is underground, and zero if not. Being underground is set to depend on a wide range of socio-demographic variables at the individual level provided by the SHIW. In the same vein, De Gregorio and Giordano (2014) use logistic regression to model the probability of being irregular worker as a function of individual characteristics and variables accounting for the local market context. Their results turn out to be consistent with those emerging in this paper.

Given that we are looking at workers who have been underground for all or most of their working life, the explanatory variables have been selected among those reflecting invariant or at least highly permanent conditions (gender and educational attainment) or accounting for the past working history (number of working experiences and kind of occupation). Only one variable reflects instead a more recent piece of information on individuals (sector of economic activity of the latest job held).

In Table 3 we report the results of the probit estimation obtained on the entire sample (1998-2014) and on the pre-crisis (1998-2008) and post crisis (2010-2014) observations separately. The comparison of the results for the two sub-periods will allow us to examine how the explanatory power of independent variables changed after the inception of the global crisis and, thus, during the period covering the euro area sovereign debt crisis and the subsequent recession. In this set of regressions the probability of working underground is measured by the broad definition of underground workers presented in Section 2. The model A considers all the socio-demographic variables listed above but the sector, which is instead included in model B.

The estimates suggest that individuals' social and economic characteristics (education, kind of job, sector) rather than demographic ones (gender and age) have a greater role in explaining the probability

of working underground. In general, the magnitude and the significance of the (marginal) effects on the first set of variables are larger and consistent over the two sample periods. The building sector, which ranked second after agriculture before the crisis according to both measures, during the crisis turned out to be the most irregular sector, as well as emerging as one of the sectors hit hardest by the crisis, with a sizeable reduction in terms of employment and turnover.

Both models show that women have a higher probability of being in irregular employment, although the divide lessens with the inception of the crisis. Once we control for sector of activity, the lower probability for men to work underground loses significance for the post crisis years (column 6). This result, coupled with that on the building sector, where men are traditionally overrepresented, confirm a crucial role for underlying economic conditions in the narrative of the phenomenon.

Age appears to play a different role before and during the crisis. Up to 2008 the probability of being irregular reduces as we depart from the youngest (14-30 years). With the crisis the proportion of irregular workers among the different age categories changes substantially. As labour market weakens, the probability of being in an irregular position becomes higher for central age classes (31-40 and 41-50 years). This result, which is in line with that in De Gregorio and Giordano (2014) for years 2010 and 2011, signals that in that economic juncture the informal sector could have represented a “last resort” for many core-age workers displaced from the formal segment more than continuing to serve as a “stepping stone” towards a regular position for the youngsters.

The effect of education attainment on the probability of working underground is, as expected, negative and strongly significant. The gain from achieving further education comes however crucially from taking a diploma, as graduates and those with a diploma have, *ceteris paribus*, broadly the same risk of being underground. The condition of having been “always independent” is crucially a risky one: the coefficient on this variable is positive and significant in the two models. Employment in the informal sector – at least in our “broad” definition – is more likely among those who have had more than one working experience.

We have also checked the robustness of our results along different dimensions. We have first restricted ourselves to the narrow measure of underground, i.e., to those who have been involved in the shadow sector throughout their whole career (Table 4). We still find a sizeable effect of education on the probability of being underground. Women face a probability of being stuck in an informality trap higher than men both before and after the crisis, no matter of the model used. The positive effect of having been “always independent” remains strongly confirmed. On the contrary, the coefficient on the variable “having had more than one working experience” becomes negative; this result suggests that an individual working for more than just one employer is less likely be stuck - either deliberately or not - in an irregular job position throughout his entire career. The probability of being underground in the narrow sense is lower for every age category different from the youngest (14-30 years) both before and after the crisis, again confirming the “stepping stone” argument discussed before. Results on sectors are confirmed except for the building sector whose coefficient remains negative and significant even after 2008. Then we included sample weights in the regressions (Tables 5 and 6). As a whole we derive fairly consistent results. We have also changed the threshold (from 10 to 5 years) used in the absolute criterion; the result on the change in the pattern by age due to the crisis is confirmed (Figure 2).

#### **4. Conclusions**

We have used data from the SHIW, which allows identifying irregular workers by relying on individuals' self-reported social security positions, to identify underground workers and assess their characteristics before and in course of the global financial and economic crisis.

We have shown that individuals' social and economic characteristics (education, kind of job, sector) rather than demographic ones (gender and age) play a greater role in explaining the probability of working underground. Moreover, we show that the financial and economic crisis partially changed the potential impact of some determinants behind irregular employment. In particular, before the crisis women showed a higher probability of being in irregular employment than men; this divide lessens after 2008. Also age appears to change its impact before and during the crisis: as labour market weakens, the probability of being in an irregular position reaches its maximum for core-age workers.

Our analysis confirms that low education levels considerably and significantly increase the probability of working permanently underground. This result holds, on an empirical standpoint, for the entire period under analysis and suggests active policies in terms of training (throughout the whole working life) as a policy prescription to combat the phenomenon.



## References

- Ardizzi, G., Petraglia, C., Piacenza, M. and G. Turati (2014) “Measuring the Underground Economy with the Currency Demand Approach: A Reinterpretation of the Methodology, With an Application to Italy”, *Review of Income and Wealth*, vol. 60(4), pages 747-772, December.
- Bank of Italy (2015) “Household income and Wealth in 2014”, Supplement to the Statistical Bulletin – Sample surveys, 64.
- Barone, G. and S. Mocetti (2011) “Tax morale and public spending inefficiency”, *International Tax and Public Finance*, Springer, vol. 18(6), pages 724-749, December.
- Boeri, T. and P. Garibaldi (2007) “Shadow sorting”, in Pissarides, C. and Frenkel, J. (eds.), NBER International Seminar on Macroeconomics 2005, MIT Press.
- Bordignon, M. and A. Zanardi (1997) “Tax evasion in Italy”, *Giornale degli Economisti e Annali di Economia*, 56, 169-210.
- Bovi, M. (1999) “Un miglioramento del metodo di Tanzi per la stima dell’economia sommersa in Italia”, Istat, *Rivista di Statistica Ufficiale*, 2, 5-52.
- Brandolini, A. and G. D’Alessio (2002) “Evidenze sul lavoro sommerso nell’Indagine della Banca d’Italia sui bilanci delle famiglie italiane”, Bank of Italy, manuscript.
- Cannari, L., Ceriani, V. and G. D’Alessio (1997) “Il recupero degli imponibili sottratti a tassazione”, Bank of Italy, Quantitative research for economic policy.
- Cannari, L. and G. D’Alessio (1990) “Housing Assets in the Bank of Italy’s Survey of Household Income and Wealth”, in Dagum and Zenga (eds.), *Income and Wealth Distribution, Inequality and Poverty*, Berlin, Springer-Verlag.
- Cannari, L. and D’Alessio, G. (2007), “The opinion of Italians on tax evasion”, Bank of Italy, Temi di Discussione no. 618.
- Capasso, S. and T. Jappelli (2013) “Financial development and the underground economy”, *Journal of Development Economics*, Elsevier, vol. 101(C), pages 167-178.
- Cappariello, R. and R. Zizza (2010) “Dropping the books and working off the books”, *Labour*, vol. 24, No. 2, pp. 139-62.
- Fiorio, C.V. and F. D’Amuri (2005) “Workers’ tax evasion in Italy”, *Giornale degli Economisti ed Annali d’Economia*, 64, 247-270.

- D'Amuri, F., S. Fabiani, R. Sabbatini, R. Tartaglia Polcini, F. Venditti, E. Viviano and R. Zizza (2015) "Wages and prices in Italy during the crisis: the firms' perspective", Bank of Italy, Occasional paper no. 289.
- D'Aurizio, L., I. Faiella, S. Iezzi, and A. Neri (2006) "The underreporting of financial wealth in the Survey on Household Income and Wealth", Bank of Italy, Discussion paper no. 610.
- De Gregorio, C. and A. Giordano (2015) "Heterogeneity of irregular employment in Italy: some evidence from Labour force survey integrated with administrative data", Istat Working paper no.1.
- Di Porto, E. (2009) "Audit, tax compliance and undeclared work: an empirical analysis", LABORatorio R. Revelli Working Papers Series 94, LABORatorio R. Revelli, Centre for Employment Studies.
- Di Porto, E. and L. Elia (2011) "Undeclared work and wage inequality", Working paper Università della Calabria no. 8.
- Filippin, A., Fiorio, C.V. and E. Viviano (2013) "The effect of tax enforcement on tax morale", *European Journal of Political Economy*, vol. 32(C), pages 320-331.
- Kaufmann, D., and A. Kaliberda (1996) "Integrating the Unofficial Economy into the Dynamics of Post-Socialist Economies: A Framework of Analysis and Evidence." In B. Kaminski (ed.) *Economic Transition in Russia and the New States of Eurasia*. Armonk, NY: M. E. Sharpe, Inc.
- Lackó, M. (1996) "Hidden economy in East-European countries in international comparison", Laxenburg: International Institute for Applied Systems Analysis (IIASA).
- Marino, M.R. and R. Zizza (2012) "Personal Income Tax Evasion in Italy: an Estimate by Taxpayer Type", in Michael Pickhardt and Aloys Prinz (eds.), *Tax evasion and the shadow economy*, Edward Elgar Publishing.
- Neri, A. and R. Zizza (2010) "Income reporting behaviour in sample surveys", Temi di discussione, Bank of Italy, No. 777.
- Pellegrini, V., A. Sanelli ed E. Tosti (2015), "What do external statistics tell us about undeclared assets held abroad and tax evasion?", contributo presentato alla conferenza *The Bank of Italy's analysis of household finances. Fifty years of the Survey on household income and wealth and the Financial accounts*, Roma, Banca d'Italia, 3-4 dicembre 2015.
- Schneider, F. and D.H. Enste (2000) "Shadow economies around the world: size, causes and consequences", IMF Working Paper No. 26.
- Zizza, R. (2002) "Metodologie di stima dell'economia sommersa: un'applicazione al caso italiano", Bank of Italy, Temi di Discussione No. 463.

## Tables

**Table 1. Percentage incidence of irregularity: estimates from SHIW and Istat**

year	SHIW		Istat		
	Narrow	Broad	Rate of irregular workers	Rate of irregular full time equivalent units	Rate of irregular jobs
1998	8.6	21.0	14.2	16.5	17.4
2000	7.7	19.8	13.9	16.4	17.3
2002	6.4	17.0	13.3	15.5	16.9
2004	6.9	18.2	12.4	14.4	16.1
2006	8.0	19.1	12.5	14.7	16.0
2008	7.4	20.6	12.2	14.5	15.3
2010	5.7	19.4	12.3	14.5	14.9
2012	5.1	20.2	12.6	14.9	14.8
2014 (*)	5.6	19.0	12.8	15.0	15.1
<b>Average</b>	<b>6.8</b>	<b>19.4</b>	<b>12.9</b>	<b>15.1</b>	<b>16.0</b>

*Notes:* our calculations on 1998-2014 SHIW. Averages are computed using sample weights and using the entire sample of individuals between 14 and 67 years old. (\*) Year 2013 for Istat.

**Table 2. Percentage incidence of irregularity in selected groups.  
Narrow and broad measures**

Groups	Narrow 1998-2008	Narrow 2010-2014	Broad 1998-2008	Broad 2010-2014
Men	6.5	4.6	16.9	18.4
Women	8.7	6.6	22.4	20.9
14-30 years old	16.6	12.1	17.5	12.9
31-40 years old	7.8	7.2	17.6	19.5
41-50 years old	5.3	4.7	20.9	23.3
51-67 years old	4.2	2.9	20.2	18.7
North	3.9	2.4	13.9	13.7
Centre	7.8	4.7	18.7	17.9
South and Isles	13.8	11.4	29.6	30.7
Compulsory school or below	8.4	7.7	25.9	28.7
High school	6.3	4.2	13.1	14.6
College degree or beyond	7.4	3.4	11.7	9.8
Always dependent worker	7.0	5.4	18.3	19.3
Always independent worker	14.2	9.0	24.6	18.6
Either independent or dependent	4.5	3.0	20.2	21.9
Only one job in working history	9.7	6.6	19.9	17.4
More than one job in working history	4.9	4.4	18.5	21.7
Agriculture	7.2	7.6	22.0	24.6
Manufacturing	3.6	1.9	11.2	12.5
Construction	10.6	7.7	29.8	33.4
Services	6.2	4.6	13.7	14.4
Total	7.5	5.5	19.3	19.5

*Notes:* our estimations on 1998-2014 SHIW.

**Table 3. Probability of working underground (broad measure)**

Explanatory variables	Model A			Model B		
	Entire sample (1)	<=2008 (2)	>2008 (3)	Entire sample (4)	<=2008 (5)	>2008 (6)
Male	-0.0844*** (0.00269)	-0.0909*** (0.00325)	-0.0691*** (0.00480)	-0.0181*** (0.00262)	-0.0225*** (0.00316)	-0.00661 (0.00469)
Age 31-40	-0.000783 (0.00444)	-0.0166*** (0.00491)	0.0549*** (0.0103)	-0.0142*** (0.00386)	-0.0288*** (0.00424)	0.0353*** (0.00902)
Age 41-50	0.0152*** (0.00437)	-0.00285 (0.00491)	0.0712*** (0.00955)	-0.00643* (0.00380)	-0.0232*** (0.00423)	0.0437*** (0.00836)
Age 51-67	-0.0206*** (0.00400)	-0.0248*** (0.00457)	0.0044 (0.00827)	-0.0501*** (0.00349)	-0.0511*** (0.00398)	-0.0341*** (0.00725)
More than 1 working experience	0.0231*** (0.00294)	0.0127*** (0.00354)	0.0434*** (0.00526)	0.0420*** (0.00282)	0.0324*** (0.00340)	0.0640*** (0.00504)
High school	-0.120*** (0.00256)	-0.117*** (0.00306)	-0.126*** (0.00467)	-0.0846*** (0.00251)	-0.0792*** (0.00301)	-0.0950*** (0.00453)
Degree or beyond	-0.134*** (0.00251)	-0.124*** (0.00318)	-0.151*** (0.00418)	-0.0881*** (0.00266)	-0.0770*** (0.00343)	-0.106*** (0.00430)
Always independent	0.0712*** (0.00471)	0.0802*** (0.00557)	0.0461*** (0.00877)	0.0728*** (0.00454)	0.0813*** (0.00539)	0.0526*** (0.00841)
Either depend. or indep.	0.0370*** (0.00449)	0.0427*** (0.00549)	0.0290*** (0.00787)	0.0361*** (0.00422)	0.0491*** (0.00522)	0.0127* (0.00714)
Manufacturing				-0.118*** (0.00302)	-0.127*** (0.00349)	-0.0843*** (0.00667)
Building sector				-0.0237*** (0.00467)	-0.0349*** (0.00511)	0.0238** (0.0112)
Services				-0.131*** (0.00438)	-0.139*** (0.00488)	-0.0852*** (0.00920)
<i>Observations</i>	92.878	64.296	28.582	87.196	60.270	26.926

*Notes:* variables are all dummies. See Table 2 for omitted categories. Marginal effects evaluated at the sample mean. Robust standard errors are reported in parentheses. The symbols \*\*\*, \*\*, \* indicate a significance level of 1 per cent, 5 per cent and 10 per cent respectively.

**Table 4. Probability of working underground (narrow measure)**

Explanatory variables	Model A			Model B		
	Entire sample (1)	<=2008 (2)	>2008 (3)	Entire sample (4)	<=2008 (5)	>2008 (6)
Male	-0.0333*** (0.00143)	-0.0342*** (0.00181)	-0.0299*** (0.00222)	-0.0132*** (0.00127)	-0.0134*** (0.00160)	-0.0116*** (0.00190)
Age 31-40	-0.0359*** (0.00117)	-0.0414*** (0.00146)	-0.0222*** (0.00195)	-0.0294*** (0.000967)	-0.0341*** (0.00123)	-0.0179*** (0.00150)
Age 41-50	-0.0535*** (0.00120)	-0.0607*** (0.00147)	-0.0357*** (0.00200)	-0.0434*** (0.00106)	-0.0490*** (0.00131)	-0.0291*** (0.00169)
Age 51-67	-0.0810*** (0.00166)	-0.0826*** (0.00193)	-0.0718*** (0.00317)	-0.0734*** (0.00153)	-0.0748*** (0.00179)	-0.0645*** (0.00291)
More than 1 working experience	-0.00686*** (0.00147)	-0.00934*** (0.00188)	-0.00226 (0.00220)	-0.00384*** (0.00129)	-0.00536*** (0.00166)	-0.000278 (0.00186)
High school	-0.0286*** (0.00132)	-0.0282*** (0.00166)	-0.0277*** (0.00206)	-0.0173*** (0.00118)	-0.0158*** (0.00151)	-0.0187*** (0.00180)
Degree or beyond	-0.0250*** (0.00137)	-0.0208*** (0.00195)	-0.0280*** (0.00172)	-0.0138*** (0.00133)	-0.00883*** (0.00196)	-0.0186*** (0.00154)
Always independent	0.0530*** (0.00298)	0.0612*** (0.00373)	0.0335*** (0.00467)	0.0424*** (0.00263)	0.0486*** (0.00332)	0.0282*** (0.00406)
Either depend. or indep.	-0.00173 (0.00240)	0.000647 (0.00314)	-0.00528 (0.00338)	0.000628 (0.00211)	0.00416 (0.00281)	-0.00520* (0.00275)
Manufacturing				-0.0358*** (0.00124)	-0.0412*** (0.00159)	-0.0224*** (0.00193)
Building sector				-0.0145*** (0.00150)	-0.0163*** (0.00185)	-0.00883*** (0.00254)
Services				-0.0377*** (0.00207)	-0.0431*** (0.00245)	-0.0200*** (0.00350)
Observations	92.878	64.296	28.582	87.196	60.270	26.926

Notes: variables are all dummies. See Table 2 for omitted categories. Marginal effects evaluated at the sample mean. Robust standard errors are reported in parentheses. The symbols \*\*\*, \*\*, \* indicate a significance level of 1 per cent, 5 per cent and 10 per cent respectively.

**Table 5. Probability of working underground (broad measure)**

Explanatory variables	Model A			Model B		
	Entire sample (1)	<=2008 (2)	>2008 (3)	Entire sample (4)	<=2008 (5)	>2008 (6)
Male	-0.0784*** (0.00370)	-0.0881*** (0.00447)	-0.0583*** (0.00651)	-0.0150*** (0.00367)	-0.0226*** (0.00444)	0.00166 (0.00636)
Age 31-40	0.00717 (0.00611)	-0.0124* (0.00679)	0.0720*** (0.0137)	-0.00866 (0.00536)	-0.0264*** (0.00592)	0.0498*** (0.0121)
Age 41-50	0.0314*** (0.00609)	0.0105 (0.00689)	0.0930*** (0.0128)	0.00803 (0.00534)	-0.0104* (0.00599)	0.0621*** (0.0113)
Age 51-67	-0.0051 (0.00548)	-0.0129** (0.00630)	0.0293*** (0.0112)	-0.0388*** (0.00474)	-0.0433*** (0.00544)	-0.0136 (0.00966)
More than 1 working experience	0.0220*** (0.00411)	0.00611 (0.00500)	0.0497*** (0.00719)	0.0410*** (0.00394)	0.0272*** (0.00483)	0.0670*** (0.00672)
High school	-0.117*** (0.00358)	-0.116*** (0.00428)	-0.119*** (0.00644)	-0.0817*** (0.00355)	-0.0768*** (0.00425)	-0.0923*** (0.00631)
Degree or beyond	-0.128*** (0.00363)	-0.118*** (0.00462)	-0.144*** (0.00592)	-0.0841*** (0.00387)	-0.0707*** (0.00505)	-0.105*** (0.00598)
Always independent	0.0501*** (0.00642)	0.0635*** (0.00776)	0.0153 (0.0111)	0.0574*** (0.00625)	0.0713*** (0.00761)	0.0250** (0.0107)
Either depend. or indep.	0.0346*** (0.00624)	0.0456*** (0.00766)	0.0199* (0.0108)	0.0349*** (0.00594)	0.0539*** (0.00745)	0.00417 (0.00971)
Manufacturing				-0.109*** (0.00455)	-0.115*** (0.00522)	-0.0848*** (0.00959)
Building sector				-0.00893 (0.00709)	-0.0227*** (0.00774)	0.0330** (0.0162)
Services				-0.117*** (0.00626)	-0.129*** (0.00691)	-0.0696*** (0.0132)
<i>Observations</i>	92.150	63.568	28.582	86.496	59.570	26.926

*Notes:* variables are all dummies. See Table 2 for omitted categories. Marginal effects evaluated at the sample mean. Sample weights included. Robust standard errors are reported in parentheses. The symbols \*\*\*, \*\*, \* indicate a significance level of 1 per cent, 5 per cent and 10 per cent respectively.

**Table 6. Probability of working underground (narrow measure)**

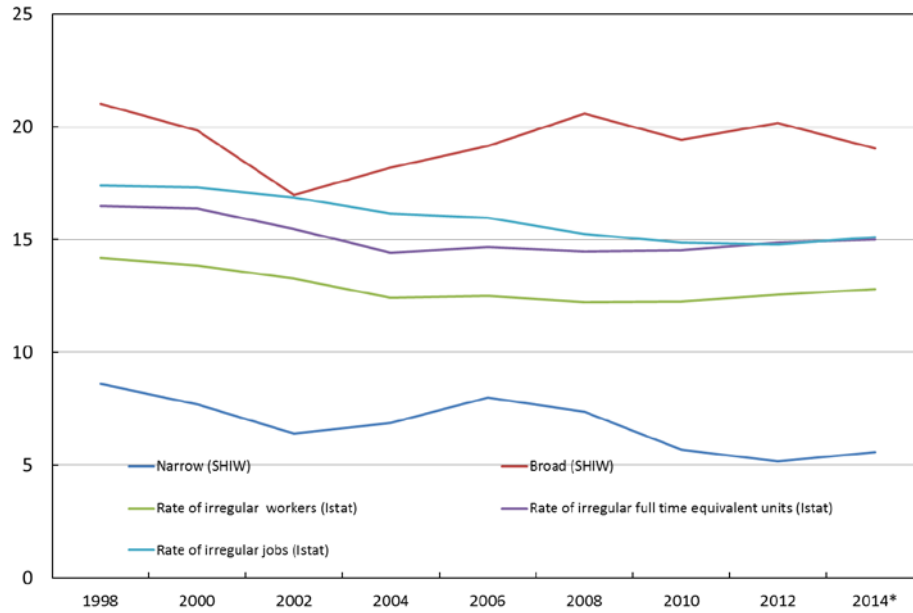
Explanatory variables	Model A			Model B		
	Entire sample (1)	<=2008 (2)	>2008 (3)	Entire sample (4)	<=2008 (5)	>2008 (6)
Male	-0.0303*** (0.00203)	-0.0323*** (0.00265)	-0.0258*** (0.00294)	-0.0110*** (0.00185)	-0.0122*** (0.00247)	-0.00789*** (0.00242)
Age 31-40	-0.0365*** (0.00177)	-0.0437*** (0.00226)	-0.0209*** (0.00286)	-0.0312*** (0.00147)	-0.0379*** (0.00190)	-0.0170*** (0.00224)
Age 41-50	-0.0525*** (0.00173)	-0.0599*** (0.00214)	-0.0356*** (0.00288)	-0.0442*** (0.00151)	-0.0499*** (0.00187)	-0.0301*** (0.00252)
Age 51-67	-0.0708*** (0.00197)	-0.0758*** (0.00239)	-0.0571*** (0.00342)	-0.0645*** (0.00177)	-0.0700*** (0.00218)	-0.0493*** (0.00296)
More than 1 working experience	-0.00974*** (0.00220)	-0.0147*** (0.00292)	-0.00118 (0.00303)	-0.00649*** (0.00198)	-0.00935*** (0.00268)	-0.00119 (0.00249)
High school	-0.0285*** (0.00191)	-0.0283*** (0.00245)	-0.0281*** (0.00289)	-0.0178*** (0.00179)	-0.0158*** (0.00234)	-0.0201*** (0.00262)
Degree or beyond	-0.0244*** (0.00204)	-0.0192*** (0.00303)	-0.0286*** (0.00236)	-0.0145*** (0.00200)	-0.00804*** (0.00312)	-0.0200*** (0.00207)
Always independent	0.0467*** (0.00414)	0.0543*** (0.00522)	0.0301*** (0.00648)	0.0386*** (0.00375)	0.0463*** (0.00487)	0.0219*** (0.00524)
Either depend. or indep.	-0.000069 (0.00365)	0.00427 (0.00505)	-0.00623 (0.00458)	0.00177 (0.00331)	0.00688 (0.00470)	-0.00608* (0.00361)
Manufacturing				-0.0365*** (0.00192)	-0.0419*** (0.00252)	-0.0257*** (0.00261)
Building sector				-0.0136*** (0.00242)	-0.0166*** (0.00301)	-0.00815** (0.00371)
Services				-0.0346*** (0.00307)	-0.0415*** (0.00370)	-0.0184*** (0.00498)
Observations	92.150	63.568	28.582	86.496	59.570	26.926

Notes: variables are all dummies. See Table 2 for omitted categories. Marginal effects evaluated at the sample mean. Sample weights included. Robust standard errors are reported in parentheses. The symbols \*\*\*, \*\*, \* indicate a significance level of 1 per cent, 5 per cent and 10 per cent respectively.



# Figures

**Figure 1. Percentage incidence of irregularity: estimates from SHIW and Istat**



\* Year 2013 for Istat.

**Figure 2. Predicted probabilities of working underground by age (*broad measures*)**

